Claims

Please note the claims remain as follows, and note also that the following listing of claims replaces all prior versions, and prior listings of claims in the application:

Listing of Claims:

1. (Previously Presented) Non-destructive testing apparatus, comprising:

a photon source, said photon source producing photons having a predetermined energy and directing the photons toward a specimen being tested, the photons from said photon source resulting in the creation of positrons within the specimen being tested;

a detector, said detector positioned adjacent the specimen being tested so that said detector detects gamma rays produced by annihilation of positrons with electrons; and

a data processing system operatively associated with said detector, said data processing system producing output data indicative of the presence or absence of a lattice defect in the specimen being tested.

2. (Original) The non-destructive testing apparatus of claim 1, wherein said photon source comprises a source of bremsstrahlung photons.

3. (Original) The non-destructive testing apparatus of claim 2, wherein said source of bremsstrahlung photons comprises:

an electron accelerator, said electron accelerator accelerating a stream of electrons to a predetermined energy; and

a target operatively associated with said electron generator, said target intercepting the stream of electrons from said electron accelerator and producing photons.

4. (Withdrawn from Consideration) The non-destructive testing apparatus of claim 1, wherein said photon source comprises an isotopic photon source.

5. (Original) The non-destructive testing apparatus of claim 1, wherein said detector comprises a germanium detector.

6. (Canceled)

7. (Previously Presented) The non-destructive testing apparatus of claim 1, wherein said data processing system is operatively associated with said photon source, said data processing system operating said photon source to produce photons having the predetermined energies.

8. (Previously Presented) Non-destructive testing apparatus, comprising:

photon generating means for producing photons having predetermined energies and for directing the photons toward a specimen being tested, the photons from said photon generating means resulting in the creation of positrons within the specimen being tested;

detecting means for detecting gamma rays produced by annihilation of positrons with electrons within the specimen being tested and for producing an output indicative of a material characteristic of the specimen being tested; and

data processing means operatively associated with said detecting means for producing output data indicative of the presence or absence of a lattice defect in the specimen being tested.

9-19 (Canceled)

20. (Previously Presented) Non-destructive testing apparatus, comprising:

a photon source, said photon source producing photons having a predetermined energy and directing the photons toward a specimen being tested, the photons from said photon source resulting in the creation of positrons within the specimen being tested;

a detector positioned adjacent the specimen being tested, said detector producing raw data indicative of a positron annihilation event; and

a data processing system operatively associated with said detector and said photon source, said data processing system operating in accordance with a normal activation/analysis process when a half-life of a selected positron emitter within the specimen being tested is greater than a predetermined half-life, said data processing system operating in accordance with a rapid activation/analysis process when a half-life of the selected positron emitter within the specimen being tested is less than the predetermined half-life, said data processing system, when operated in accordance with the rapid activation/analysis process, alternatively activating said photon source

and detecting raw data indicative of a positron annihilation event, said data processing system including a Doppler broadening algorithm, said Doppler broadening algorithm processing raw data indicative of a positron annihilation event to produce output data indicative of the presence or absence of a lattice defect in the specimen being tested.

21. (Previously Presented) The non-destructive testing apparatus of claim 20, wherein said detector produces raw data indicative of a positron formation event, and wherein said data processing system includes a positron lifetime algorithm, said positron lifetime algorithm processing raw data indicative of a positron formation event to produce output data indicative of a changing presence or absence of a lattice defect.

22. (Previously Presented) The non-destructive testing apparatus of claim 20, further comprising a second detector positioned adjacent the specimen being tested, said second detector producing raw data indicative of a positron formation event, wherein said data processing system includes a positron lifetime algorithm, said positron lifetime algorithm processing data indicative of a positron formation event to produce output data indicative of a changing presence or absence of a lattice defect.

23. (Previously Presented) The non-destructive testing apparatus of claim 20, wherein said data processing system includes a selective activation algorithm, said selective activation algorithm responsive to a user input, said selective activation algorithm operating said photon source to produce photons having the predetermined energies in response to the user input.

24. (Previously Presented) The non-destructive testing apparatus of claim 20, wherein said data processing system includes a three-dimensional imaging algorithm, said three-dimensional imaging algorithm processing raw data indicative of a positron annihilation event to produce output data indicative of a location of the presence or absence of a lattice defect within the specimen being tested.

25. (Canceled)

26. (Previously Presented) Non-destructive testing apparatus, comprising:

positron activation means for activating a positron emitter within a specimen being tested;

detector means for detecting a positron annihilation event within the specimen being tested and for producing raw data indicative of the positron annihilation event;

means for alternately activating the positron emitter within the specimen being tested and detecting a positron annihilation event; and

data processing means operatively associated with said detector means, said data processing means processing raw data indicative of the positron annihilation event in accordance with a Doppler broadening algorithm to produce output data indicative of the presence or absence of a lattice defect in the specimen being tested.

27. (Previously Presented) The non-destructive testing apparatus of claim 26, wherein said detector means detects a positron formation event and a positron annihilation event and produces raw data indicative of the positron formation event and the positron annihilation event, and wherein said data processing means processes raw data indicative of the positron formation event in accordance with a positron lifetime algorithm to produce output data indicative of a changing presence or absence of a lattice defect.

28. (Previously Presented) The non-destructive testing apparatus of claim 26, further comprising second detector means for detecting a positron formation event and for producing raw data indicative of the positron formation event, wherein said data processing means processes raw data indicative of the positron formation event in accordance with a positron lifetime algorithm to produce output data indicative of a changing presence or absence of a lattice defect.

29. (Canceled)

30. (Previously Presented) The non-destructive testing apparatus of claim 26, wherein said means for alternately activating the positron emitter within the specimen being tested and detecting a positron annihilation event comprises means for moving the specimen being tested between an activation position and a detection position.

31. (Previously Presented) Non-destructive testing apparatus, comprising:

a photon source, said photon source producing photons having a predetermined energy and directing the photons toward a specimen being tested, the photons from said photon source resulting in the creation of positrons within the specimen being tested;

a detector positioned adjacent the specimen being tested, said detector producing raw data related to a positron annihilation event; and

a Doppler broadening processor operatively associated with said detector and responsive to the raw data produced thereby, said Doppler broadening processor producing output data indicative of the presence or absence of a lattice defect in the specimen being tested.

32. (Previously Presented) The non-destructive testing apparatus of claim 31, further comprising three-dimensional imaging apparatus operatively associated with said detector and responsive to the raw data produced thereby, said three-dimensional imaging apparatus producing output data indicative of a location of the presence or absence of a lattice defect within the specimen being tested.

33. (Previously Presented) The non-destructive testing apparatus of claim 31, wherein said detector produces raw data that include data indicative of a positron formation event and data indicative of a positron annihilation event, said non-destructive testing apparatus further comprising a positron lifetime processor operatively associated with said detector and responsive to the raw data produced thereby, said positron lifetime processor producing output data indicative of the presence or absence of a lattice defect of the specimen being tested and indicative of a changing presence or absence of a lattice defect.

34. (Previously Presented) Non-destructive testing apparatus, comprising:

a photon source, said photon source producing photons having a predetermined energy and directing the photons toward a specimen being tested, the photons from said photon source resulting in the creation of positrons within the specimen being tested;

a detector positioned adjacent the specimen being tested, said detector producing raw data indicative of a positron formation event and a positron annihilation event; and

a positron lifetime processor operatively associated with said detector and responsive to the raw data produced thereby, said positron lifetime processor producing output data indicative

of a the presence or absence of a lattice defect in the specimen being tested and indicative of a changing presence or absence of a lattice defect.

35. (Previously Presented) The non-destructive testing apparatus of claim 34, further comprising three-dimensional imaging apparatus operatively associated with said detector and responsive to the raw data produced thereby, said three-dimensional imaging apparatus producing output data indicative of a location of the presence or absence of a lattice defect within the specimen being tested.

36. (Previously Presented) Non-destructive testing apparatus, comprising:

a photon source, said photon source producing photons having a predetermined energy and directing the photons toward a specimen being tested, the photons from said photon source resulting in the creation of positrons within the specimen being tested;

a detector positioned adjacent the specimen being tested, said detector producing raw data indicative of a positron formation event and a positron annihilation event; and

a data processing system operatively associated with said detector, said data processing system including:

a Doppler broadening algorithm, said Doppler broadening algorithm processing raw data indicative of a positron annihilation event to produce output data indicative of a presence or absence of a lattice defect in the specimen being tested;

a positron lifetime algorithm, said positron lifetime algorithm processing raw data indicative of a positron formation event to produce output data indicative of a changing presence or absence of a lattice defect; and

a three-dimensional imaging algorithm, said three-dimensional imaging algorithm processing raw data indicative of a positron annihilation event to produce output data indicative of a location of the presence or absence of a lattice defect within the specimen being tested.